

# 5

A # 1

# 6

NAME \_\_\_\_\_ DATE \_\_\_\_\_ PERIOD \_\_\_\_\_

### 9-4 Study Guide and Intervention

#### Factoring Trinomials: $ax^2 + bx + c$

**Factor  $ax^2 + bx + c$**  To factor a trinomial of the form  $ax^2 + bx + c$ , find two integers,  $m$  and  $n$  whose product is equal to  $ac$  and whose sum is equal to  $b$ . If there are no integers that satisfy these requirements, the polynomial is called a **prime polynomial**.

**Example 1** Factor  $2x^2 + 15x + 18$ .

In this example,  $a = 2$ ,  $b = 15$ , and  $c = 18$ . You need to find two numbers whose sum is 15 and whose product is  $2 \cdot 18$  or 36. Make a list of the factors of 36 and look for the pair of factors whose sum is 15.

Factors of 36	Sum of Factors
1, 36	37
2, 18	20
3, 12	15

Use the pattern  $ax^2 + mx + nx + c$ , with  $a = 2$ ,  $m = 3$ ,  $n = 12$ , and  $c = 18$ .

$$\begin{aligned} 2x^2 + 15x + 18 &= 2x^2 + 3x + 12x + 18 \\ &= (2x^2 + 3x) + (12x + 18) \\ &= x(2x + 3) + 6(2x + 3) \\ &= (x + 6)(2x + 3) \end{aligned}$$

Therefore,  $2x^2 + 15x + 18 = (x + 6)(2x + 3)$ .

#### Exercises

Factor each trinomial, if possible. If the trinomial cannot be factored using integers, write **prime**.

- |  |   |  |
|--|---|--|
| 1. $2x^2 - 3x - 2$<br>$(2x + 1)(x - 2)$    | 2. $3m^2 - 8m - 3$<br>$(3m + 1)(m - 3)$       | 3. $16r^2 - 8r + 1$<br>$(4r - 1)(4r - 1)$    |
| 4. $6x^2 + 5x - 6$<br>$(2x + 3)(3x - 2)$   | 5. $3x^2 + 2x - 8$<br>$(3x - 4)(x + 2)$       | 6. $18x^2 - 27x - 5$<br>$(3x - 5)(6x + 1)$   |
| 7. $2a^2 + 5a + 3$<br>$(2a + 3)(a + 1)$    | 8. $18y^2 + 9y - 5$<br>$(6y + 5)(3y - 1)$     | 9. $-4c^2 + 19c - 21$<br>$(4c - 7)(3 - c)$   |
| 10. $8x^2 - 4x - 24$<br>$(4x - 8)(2x + 3)$ | 11. $28p^2 + 60p - 25$<br>$(2p + 5)(14p - 5)$ | 12. $48x^2 + 22x - 15$<br>$(6x + 5)(8x - 3)$ |
| 13. $3y^2 - 6y - 24$<br>$3(y + 2)(y - 4)$  | 14. $4x^2 + 26x - 48$<br>$2(x + 8)(2x - 3)$   | 15. $8m^2 - 44m + 48$<br>$4(2m - 3)(m - 4)$  |
| 16. $6x^2 - 7x + 18$<br>prime              | 17. $2a^2 - 14a + 18$<br>$2(a^2 - 7a + 9)$    | 18. $18 + 11y + 2y^2$<br>prime               |

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### 9-4 Study Guide and Intervention (continued)

#### Factoring Trinomials: $ax^2 + bx + c$

**Solve Equations by Factoring** Factoring and the Zero Product Property can be used to solve some equations of the form  $ax^2 + bx + c = 0$ .

**Example** Solve  $12x^2 + 3x = 2 - 2x$ . Check your solutions.

$12x^2 + 3x = 2 - 2x$	Original equation
$12x^2 + 5x - 2 = 0$	Rewrite equation so that one side equals 0.
$(3x + 2)(4x - 1) = 0$	Factor the left side.
$3x + 2 = 0$ or $4x - 1 = 0$	Zero Product Property
$x = -\frac{2}{3}$ $x = \frac{1}{4}$	Solve each equation.

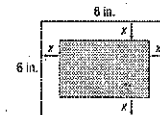
The solution set is  $\{-\frac{2}{3}, \frac{1}{4}\}$ .

Since  $12(-\frac{2}{3})^2 + 3(-\frac{2}{3}) = 2 - 2(-\frac{2}{3})$  and  $12(\frac{1}{4})^2 + 3(\frac{1}{4}) = 2 - 2(\frac{1}{4})$ , the solutions check.

#### Exercises

Solve each equation. Check your solutions.

- |   |  |   |
|---|--|---|
| 1. $8x^2 + 2x - 3 = 0$<br>$(\frac{1}{2}, -\frac{3}{4})$   | 2. $3n^2 - 2n - 5 = 0$<br>$(-1, \frac{5}{3})$    | 3. $2d^2 - 13d - 7 = 0$<br>$(\frac{1}{2}, 7)$             |
| 4. $4x^2 = x + 3$<br>$(1, -\frac{3}{4})$                  | 5. $3x^2 - 13x = 10$<br>$(-\frac{2}{3}, 5)$      | 6. $6x^2 - 11x - 10 = 0$<br>$(-\frac{2}{3}, \frac{5}{2})$ |
| 7. $2k^2 - 40 = -11k$<br>$(-8, \frac{5}{2})$              | 8. $2p^2 = -21p - 40$<br>$(-\frac{5}{2}, -8)$    | 9. $-7 - 18x + 9x^2 = 0$<br>$(\frac{7}{3}, \frac{1}{3})$  |
| 10. $12x^2 - 15 = -8x$<br>$(-\frac{3}{2}, \frac{5}{6})$   | 11. $7a^2 = -65a - 18$<br>$(-\frac{2}{7}, -9)$   | 12. $16y^2 - 2y - 3 = 0$<br>$(\frac{1}{2}, -\frac{3}{8})$ |
| 13. $8x^2 + 5x = 3 + 7x$<br>$(\frac{3}{4}, -\frac{1}{2})$ | 14. $4a^2 - 18a + 5 = 15$<br>$(-\frac{1}{2}, 5)$ | 15. $3b^2 - 18b = 10b - 49$<br>$(\frac{7}{3}, 7)$         |
16. The difference of the squares of two consecutive odd integers is 24. Find the integers.  
-5, -7 and 5, 7
17. **GEOMETRY** The length of a Charlotte, North Carolina, conservatory garden is 20 yards greater than its width. The area is 300 square yards. What are the dimensions?  
30 yd by 10 yd
18. **GEOMETRY** A rectangle with an area of 24 square inches is formed by cutting strips of equal width from a rectangular piece of paper. Find the dimensions of the new rectangle if the original rectangle measures 8 inches by 6 inches. **6 in. by 4 in.**



# 7

From Most Maddy...

1)  $u^2 + 19u = -60$

$u^2 + 19u + 10 = 0$

$(u+15)(u+4) = 0$

$u+15=0$   $u+4=0$

$u=-15$   $u=-4$

$\{-15, -4\}$

2)  $3d^2 = 10 - 13d$

$3d^2 + 13d - 10 = 0$

$(3d - 2)(d + 5) = 0$

$3d - 2 = 0$   $d + 5 = 0$

$d = \frac{2}{3}$   $d = -5$

$\{-5, \frac{2}{3}\}$

3)  $3a^2 + a = a^2 + 10a + 11$

$2a^2 - 9a - 11 = 0$

$(a+1)(2a-11) = 0$

$a+1=0$   $2a-11=0$

$a=-1$   $a=\frac{11}{2}$

$\{-1, \frac{11}{2}\}$

3)  $7x^2 - 10x = 6x^2 - 21$

$x^2 - 10x + 21 = 0$

$(x-7)(x-3) = 0$

$x-7=0$   $x-3=0$

$\{3, 7\}$

4)  $n(n+3) = 70$

$n^2 + 3n - 70 = 0$

$(n+10)(n-7) = 0$

$n+10=0$   $n-7=0$

$n=-10$   $n=7$

$\{-10, 7\}$

6)  $b(5b-4) = 12$

$5b^2 - 4b - 12 = 0$

$(b+\frac{6}{5})(b-2) = 0$

$5b+6=0$   $b-2=0$

$b=-\frac{6}{5}$   $b=2$

$\{-\frac{6}{5}, 2\}$

5)  $(w+5)(w+2) = 40$

$w^2 + 7w + 10 = 40$

$w^2 + 7w - 30 = 0$

$(w+10)(w-3) = 0$

$w+10=0$   $w-3=0$

$\{-10, 3\}$

8)  $4t^2 - 9t + 16 = 15 - 4t^2$

$8t^2 - 9t + 1 = 0$

$(t-1)(8t-1) = 0$

$t-1=0$   $8t-1=0$

$t=1$   $t=\frac{1}{8}$

$\{\frac{1}{8}, 1\}$

$$(2k+4)(2k+9) = 2k^2 + 11k$$

$$4k^2 + 20k + 36 = 2k^2 + 11k$$

$$k^2 + 9k + 36 = 0$$

$$(k+12)(k+3) = 0$$

$$k+12=0 \quad k+3=0$$

$$k = -12 \quad k = -3$$

$$\boxed{\{-12, -3\}}$$

$$\begin{array}{r} 36 \\ 12 \times 3 \\ \hline 15 \end{array}$$

12

$$x(x+5) = 84$$

$$x^2 + 5x - 84 = 0$$

$$(x+12)(x-7) = 0$$

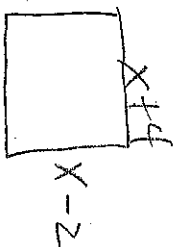
$$x+12=0 \quad x-7=0$$

$$x = -12 \quad x = 7$$

$$\boxed{70m \times 12cm}$$

$$\begin{array}{r} -84 \\ 12 \times -7 \\ \hline 15 \end{array}$$

13



$$(x+4)(x-2) = 91$$

$$x^2 + 2x - 8 = 91$$

$$x^2 + 2x - 99 = 0$$

$$(x+11)(x-9) = 0$$

$$x+11=0 \quad x-9=0$$

$$x = -11 \quad x = 9$$

$$\boxed{\{-9, 13\}}$$

$$\begin{array}{r} -99 \\ 11 \times -9 \\ \hline 13 \end{array}$$

10

$$5 + 6y(y+2) = 5y + 8$$

$$5 + 6y^2 + 12y = 5y + 8$$

$$6y^2 + 7y - 3 = 0$$

$$(y + \frac{3}{2})(y - \frac{1}{2}) = 0$$

$$2y+3=0 \quad 2y-1=0$$

$$y = -\frac{3}{2} \quad y = \frac{1}{2}$$

$$\boxed{\{-\frac{3}{2}, \frac{1}{2}\}}$$

$$\begin{array}{r} -18 \\ 7 \times -\frac{2}{3} = -\frac{14}{3} \\ \hline 13 \end{array}$$

11

$$(m-3)^2 = 64$$

$$m^2 - 6m + 9 = 64$$

$$m^2 - 6m - 55 = 0$$

$$(m+5)(m-11) = 0$$

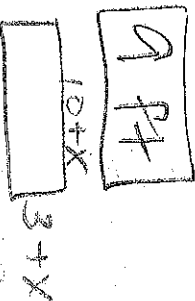
$$m+5=0 \quad m-11=0$$

$$m = -5 \quad m = 11$$

$$\boxed{\{-5, 11\}}$$

$$\begin{array}{r} -55 \\ 5 \times -11 \\ \hline -11 \end{array}$$

14



$$(x+10)(x+3) = 60$$

$$x^2 + 13x + 30 = 60$$

$$x^2 + 13x - 30 = 0$$

$$(x+15)(x-2) = 0$$

$$x+15=0 \quad x-2=0$$

$$x = -15 \quad x = 2$$

$$\boxed{12m \times 5m}$$

$$\begin{array}{r} -30 \\ 15 \times -2 \\ \hline 13 \end{array}$$

# 9 (2 pgs.)

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9-4 Skills Practice

Factoring Trinomials:  $ax^2 + bx + c$

Factor each trinomial, if possible. If the trinomial cannot be factored using integers, write *prime*.

1.  $2x^2 + 5x + 2$   
 $(x + 2)(2x + 1)$

2.  $3n^2 + 5n + 2$   
 $(3n + 2)(n + 1)$

3.  $2s^2 + 9s - 5$   
 $(s + 5)(2s - 1)$

4.  $3g^2 - 7g + 2$   
 $(3g - 1)(g - 2)$

5.  $2t^2 - 11t + 15$   
 $(t - 3)(2t - 5)$

6.  $2x^2 + 3x - 6$   
*prime*

7.  $2y^2 + y - 1$   
 $(y + 1)(2y - 1)$

8.  $4h^2 + 8h - 5$   
 $(2h + 5)(2h - 1)$

9.  $4x^2 - 3x - 3$   
*prime*

10.  $4b^2 + 15b - 4$   
 $(4b - 1)(b + 4)$

11.  $9p^2 + 6p - 8$   
 $(3p - 2)(3p + 4)$

12.  $6q^2 - 13q + 6$   
 $(3q - 2)(2q - 3)$

13.  $3a^2 + 30a + 63$   
 $3(a + 7)(a + 3)$

14.  $10w^2 - 19w - 15$   
 $(2w - 5)(5w + 3)$

Solve each equation. Check your solutions.

15.  $2x^2 + 7x + 3 = 0$   $\left\{-3, -\frac{1}{2}\right\}$

16.  $3w^2 + 14w + 8 = 0$   $\left\{-4, -\frac{2}{3}\right\}$

17.  $3n^2 - 7n + 2 = 0$   $\left\{\frac{1}{3}, 2\right\}$

18.  $5d^2 - 22d + 8 = 0$   $\left\{\frac{2}{5}, 4\right\}$

19.  $6h^2 + 8h + 2 = 0$   $\left\{-1, -\frac{1}{3}\right\}$

20.  $8p^2 - 16p = 10$   $\left\{-\frac{1}{2}, \frac{5}{2}\right\}$

21.  $9y^2 + 18y - 12 = 6y$   $\left\{-2, \frac{2}{3}\right\}$

22.  $4a^2 - 16a = -15$   $\left\{\frac{3}{2}, \frac{5}{2}\right\}$

23.  $10b^2 - 15b = 8b - 12$   $\left\{\frac{4}{5}, \frac{3}{2}\right\}$

24.  $6d^2 + 21d = 10d + 35$   $\left\{-\frac{7}{2}, \frac{5}{2}\right\}$

Lesson 9-4

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9-4 Practice (Average)

Factoring Trinomials:  $ax^2 + bx + c$

Factor each trinomial, if possible. If the trinomial cannot be factored using integers, write *prime*.

1.  $2h^2 + 10h + 12$   
 $2(b + 2)(b + 3)$

2.  $3g^2 + 8g + 4$   
 $(3g + 2)(g + 2)$

3.  $4x^2 + 4x - 3$   
 $(2x + 3)(2x - 1)$

4.  $8t^2 - 5t - 10$   
*prime*

5.  $6m^2 + 7m - 3$   
 $(3m - 1)(2m + 3)$

6.  $10d^2 + 17d - 20$   
 $(5d - 4)(2d + 5)$

7.  $6a^2 - 17a + 12$   
 $(3a - 4)(2a - 3)$

8.  $8w^3 - 18w + 9$   
 $(4w - 3)(2w - 3)$

9.  $10x^2 - 9x + 6$   
*prime*

10.  $15n^2 - n - 28$   
 $(5n - 7)(3n + 4)$

11.  $10x^2 + 21x - 10$   
 $(2x + 5)(5x - 2)$

12.  $9r^2 + 15r + 6$   
 $3(3r + 2)(r + 1)$

13.  $12y^2 - 4y - 5$   
 $(2y + 1)(6y - 5)$

14.  $14k^3 - 9k - 18$   
 $(2k - 3)(7k + 6)$

15.  $8z^2 + 20z - 48$   
 $4(z + 4)(2z - 3)$

16.  $12q^2 + 34q - 28$   
 $2(3q - 2)(2q + 7)$

17.  $18h^2 + 15h - 18$   
 $3(2h + 3)(3h - 2)$

18.  $12p^2 - 22p - 20$   
 $2(3p + 2)(2p - 5)$

Solve each equation. Check your solutions.

19.  $3h^2 + 2h - 16 = 0$   
 $\left\{-\frac{8}{3}, 2\right\}$

20.  $15n^2 - n = 2$   
 $\left\{-\frac{1}{3}, \frac{2}{5}\right\}$

21.  $8q^2 - 10q + 3 = 0$   
 $\left\{\frac{1}{2}, \frac{3}{4}\right\}$

22.  $6t^2 - 5t = 4$   
 $\left\{\frac{1}{2}, \frac{4}{3}\right\}$

23.  $10c^2 - 21c = -4c + 6$   
 $\left\{-\frac{3}{10}, 2\right\}$

24.  $10g^2 + 10 = 29g$   
 $\left\{\frac{2}{5}, \frac{5}{2}\right\}$

25.  $6y^2 = -7y - 2$   
 $\left\{\frac{2}{3}, -\frac{1}{2}\right\}$

26.  $9x^2 = -6x + 15$   
 $\left\{-\frac{5}{3}, 1\right\}$

27.  $12k^2 + 15k = 16k + 20$   
 $\left\{\frac{5}{4}, \frac{4}{3}\right\}$

28.  $12x^2 - 1 = -x$   
 $\left\{-\frac{1}{3}, \frac{1}{4}\right\}$

29.  $8a^2 - 16a = 6a - 12$   
 $\left\{\frac{3}{4}, 2\right\}$

30.  $18a^2 + 10a = -11a + 4$   
 $\left\{-\frac{4}{3}, \frac{1}{6}\right\}$

31. **DIVING** Lauren dove into a swimming pool from a 15-foot-high diving board with an initial upward velocity of 8 feet per second. Find the time  $t$  in seconds it took Lauren to enter the water. Use the model for vertical motion given by the equation  $h = -16t^2 + vt + s$ , where  $h$  is height in feet,  $t$  is time in seconds,  $v$  is the initial upward velocity in feet per second, and  $s$  is the initial height in feet. (*Hint:* Let  $h = 0$  represent the surface of the pool.) 1.25 s

32. **BASEBALL** Brad tossed a baseball in the air from a height of 6 feet with an initial upward velocity of 14 feet per second. Enrique caught the ball on its way down at a point 4 feet above the ground. How long was the ball in the air before Enrique caught it? Use the model of vertical motion from Exercise 31. 1 s